Microbial biomass as biocatalysts and bioaccumulation tool in two-step cascade process

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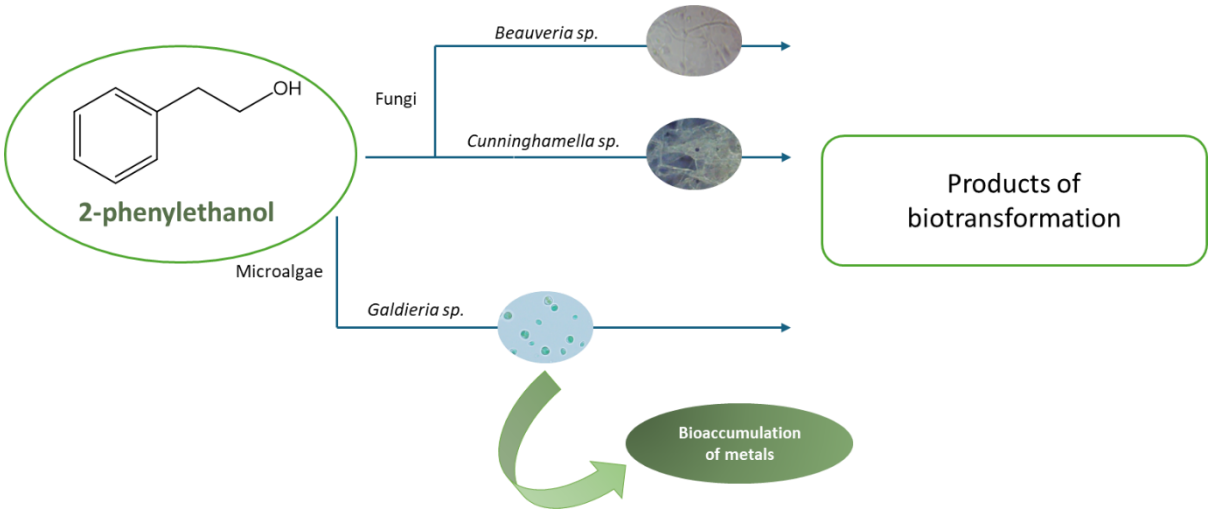

Figure 1. Graphical abstract: Microbial biomass as biocatalysts and bioaccumulation tool in two-step cascade process.

Whole-cell biotransformations are constantly explored field of possibilities of excluding chemical processes burdening the environment. They are low-cost methods of obtaining desired derivatives, especially important in case of chiral fine chemicals synthesis. As an inexpensive and widely available chemical compound 2-phenylethanol can be a valuable substrate for the preparation of many different products of antioxidant, anticancer or anti-inflammatory activity. These include among others 1-phenylethane-1,2-diol, 4-hydroxyphenylacetic acid and hydroxytyrosol [1].

Experiment started from the applying of the heterotrophic, eukaryotic biocatalysts. Fungi of the genus *Beauveria* and *Cunninghamella* are active towards 2-phenylethanol and were used as biocatalysts. To increase their specificity and protect against the possible substrate interactions, the mycelia of *B. bassiana* and *B. brongniartii* were subjected to different immobilization methods (e.g. calcium alginate, agar-agar and polyurethane foams). This was not possible for the *Cunninghamella* genus, because of its culturing features.

In the next approach photobiocatalysts were employed. The red alga *Galdieria sulphuraria* is known for its bioaccumulative abilities [2]. This gives the possibility to design the cascade two-step process applying this microalgae as biotransformation tool and then as biomass able to bioaccumulate the rare earth elements.

Cultivation and biotransformation conditions (e.g. temperature, rotation, medium, time) were individually adjusted to each microorganism.

Analysis of the reaction products was carried out using high-performance liquid chromatography (HPLC). Algal biomass tested towards rare earth elements accumulation was sent to analysis by inductively coupled plasma-mass spectrometry (ICP-MS).

All tested microorganisms (*B. bassiana, B. brongniartii, C. elegans, C. blakesleeana, C. echinulata, G. sulphuraria*) were positively verified as active towards 2-phenylethanol. However, depending on the strain selected, there were differences in the reaction efficiency and the resulting products. *G. sulphuraria* showed bioaccumulation potential towards rare earth elements but it was lower than in other tests [2], which means that previous biotransformation can influence the course of bioaccumulation.

References

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